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10/762,666	01/22/2004	Carlos Dangelo	NANOC002NP	5164
24341 7590 05/17/2007 MORGAN, LEWIS & BOCKIUS, LLP. 2 PALO ALTO SQUARE 3000 EL CAMINO REAL PALO ALTO, CA 94306			EXAMINER PAREKH, NITIN	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

No amendment after final has been filed.



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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 10/762,666
Filing Date: January 22, 2004
Appellant(s): DANGELO, CARLOS

Robert Beyers

For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 2/14/07 appealing from the Office action
mailed 7-17-06.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the prior art of record relied upon in the rejection of the claims under appeal.

2002/0130407	Dahl et al.	09-2002
5926370	Cromwell	07-1999
2003/0117770	Montgomery et al.	06-2003

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

- (i) The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

(ii) Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dahl et al. (US Pat. Application Pub. 2002/0130407) in view of Cromwell (US Pat. 5926370).

Regarding claim 28, Dahl et al. disclose an integrated circuit (IC) chip substrate/die having enhanced power dissipation and improved heat transfer structure (see Fig. 6C), the IC chip/die comprising:

- a substrate (601 in Fig. 6C) having a top surface upon which power generating devices of the IC are fabricated (see sections 0116 and 0136; 601/901 in Fig. 6/9 respectively) and a back/bottom surface essentially parallel to the top surface
- a plurality of cavities/holes (see 633/634 in Fig. 6C) extending a predetermined distance from the bottom surface to the top surface, the predetermined distance being less than the distance between the top and bottom surfaces, the cavities/holes being filled with heat conductive media (HCM) in a form of heat conducting conduits or heat pipe including highly thermally conductive medium comprising a variety of diamond containing material (sections 0007 and 0118-0122) and the cavities/holes being distributed/located directly below the IC devices/power generating devices of the substrate to provide the heat removal from the desired areas of the substrate (see Fig. 6C)
- the HCM having thermal conductivity greater than the substrate/silicon, and

- the heat produced by the IC devices/power generating devices being transferred to the back/bottom surface via the HCM

(Fig. 6C; sections 00116-0122).

Dahl et al. fail to teach the HCM comprising copper.

Cromwell teaches a heat dissipation/heat sink structure using conventional heat pipes (31 in Fig. 4b) where the heat pipes are made of conventional metal such as copper (Col. 10, line 22; Col. 9 and 10).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the HCM comprising copper as taught by Cromwell as an obvious alternative serving the purpose of heat management/dissipation in Dahl et al's IC cooling structure.

(iii) Claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dahl et al. (US Pat. Application Pub. 2002/0130407) in view of Montgomery et al. (US Pat. Application Pub. 2003/0117770).

Regarding claims 29 and 30, Dahl et al. disclose an integrated circuit (IC) chip substrate/die having enhanced power dissipation and improved heat transfer structure (see 601 in Fig. 6C), the IC chip/die comprising:

- a substrate having a top surface upon which power generating devices of the IC are fabricated (see sections 0116 and 0136; Fig. 6 and 9) and a back/bottom surface essentially parallel to the top surface
- a plurality of cavities/holes (see 633/634 in Fig. 6C) extending a predetermined distance from the bottom surface to the top surface, the predetermined distance being less than the distance between the top and bottom surfaces, the cavities/holes being filled with heat conductive media (HCM) in a form of heat conducting conduits or rods including thermally conductive medium comprising a variety of diamond containing material (sections 0007 and 0118-0122) and the cavities/holes being distributed/located directly below the IC devices/power generating devices of the substrate to provide the heat removal from the desired areas of the substrate (see Fig. 6C)
- the HCM having thermal conductivity greater than the substrate/silicon, and
- the heat produced by the IC devices/power generating devices being transferred to the back/bottom surface via the HCM

(Fig. 6C; sections 00116-0122).

Dahl et al. fail to teach the HCM comprising carbon nanotubes.

Montgomery et al. teach a thermal interface structure (TIS)/heat dissipation structure wherein the HCM comprises heat conducting rods in form of carbon nanotubes (see 26 in Fig. 4) to provide improved thermal conductivity and heat

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dissipation between a die and a heat sink for the TIS (sections 0013 and 0017; pp. 1 and 2).

It would have been obvious to a person of ordinary skill in the art at the time invention was made to incorporate the HCM comprising carbon nanotubes as taught by Montgomery et al. so that the thermal conduction and heat dissipation can be improved in Dahl et al's IC.

Regarding claims 31 and 32, Dahl et al. and Montgomery et al. teach the entire claimed structure as applied to claims 29 and 30 above, wherein Dahl et al. teach the IC devices/power generating devices comprising transistors having source/drain regions (see 902 in Fig. 9; section 0136), such device configuration in the IC package having the plurality of cavities/HCM being distributed/located along the bottom surface of the substrate (see Fig. 6C) provides the cavities/HCM directly below respective source, drain and isolation regions.

(10) Response to Argument

A. Rejection of independent claim 28 under 35 U.S.C. 103(a):

(I) Appellant argues that Dahl et al. and/or Cromwell fail to enable a person of ordinary skill to make and use the invention or teach how to make copper conduits in

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fiber form, or insert 1-100 copper conduits in to the chip; or how copper conduits would communicate with thermal vias.

However, the references are not necessarily applied for such limitations.

(II) Appellant argues that the modification of Dahl et al. by Cromwell would change the principle of operation of Dahl and would require substantial reconstruction/redesign.

However, the primary reference (Dahl et al.) disclose the IC die having the cavities/holes being filled with the HCM in the form of heat conducting conduits/heat pipes to provide the desired heat dissipation/transfer. Cromwell is applied to Dahl et al. to provide the heat pipes made of conventional copper metal material as the heat conductive medium irrespective of the size or the number of the heat pipes. Such modification would still provide the desired power/heat dissipation during the operation of IC chip based on the principle of heat conduction using copper as the HCM.

(III) Appellant argues that there is no motivation to combine the references.

However, as explained in the rejections above, Cromwell is combined with Dahl et al. to provide the HCM comprising copper as an obvious alternative serving the purpose of heat management/dissipation and being suitable for intended use in Dahl et al.'s IC cooling structure.

B. Rejection of independent claim 29 and dependent claims 30-32 under 35 U.S.C. 103(a):

(I) Appellant argues that Dahl et al. and/or Montgomery et al. fail to enable a person of ordinary skill to make and use the invention or teach how to make carbon nanotubes in fiber form; or how to insert from about 1 to 100 carbon nanotubes conduits into the chip; or how the carbon nanotube conduits would communicate with thermal vias.

However, as addressed in the response **A** (I) above, the references are not necessarily applied for such limitations.

(II) Appellant argues that Montgomery et al. fail to provide the enablement that is missing in Dahl et al. because Montgomery et al. teach making the carbon nanotube structures external to the IC die.

However, the primary reference (Dahl et al.) discloses the IC die having plurality of cavities/holes (see 633/634 in Fig. 6C) within the IC die, the cavities/holes being filled with heat conducting conduits/rods. Montgomery et al. combined with the primary reference to provide the heat conducting material of the rods in the form of carbon nanotubes. Montgomery et al. is not necessarily applied for limitations related to the enablement or how to make carbon nanotubes.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.


For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Conferees:


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PRIMARY PATENT EXAMINER

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05-08-07